

**A08845**

## Autumn weight of the partridge (*Perdix perdix* L.) in Finland

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In Finland the partridge (*Perdix perdix* L.) occurs at the northernmost limit of its geographical range (WISNIUSKOV 1964). Its presence in the country is probably partly due to immigration via the Carelian Isthmus in the 1700's, but is also partly the result of introductions made from about 1750 onwards (MLINKALO 1958, pp. 53 - 54). Invasions of areas to the south and north of Ostrobothnia and southern Finland have been observed now and then (see e.g. KUUKONEN 1950, NÖRMOHN 1951, MLINKALO 1958), but there is no evidence of regular migrations of the species in this country. Thus the study of the weight of the partridge is of both ecophysiological and taxonomic interest.

A preliminary report on the weight of the partridge in Finland was published by the present author (PELLIAINEN 1965). In the autumns 1964 - 1967 weight records of the species were collected in Ostrobothnia and southern Finland. The purpose of the present paper is to provide records of the geographical and year-to-year variation in the weights of the different sexes and age classes of the partridge in October.

### 1. Material and methods

The Ostrobothnian study area consists of the following communes (Fig. 1): Alahärmä, Alajärvi, Simojoki, Salajärvi, Rautjärvi, Koivisto, Kuortane, Kurikka, Lapua, Nurmo, Pyysäläjoki, Seinäjoki and Vimpeli. In southern Finland weight records were collected in the following communes (Fig. 1): Helsinki, Masku (Naantali), Porvoo (Pukkilan) and Somero.

In each of the years 1964 - 1967 the open season for partridge was in October. The partridges were shot fairly regularly throughout this month. The figures for weights were taken to the nearest 5 g (or in some cases to the nearest 10 g) and, when possible, the birds were weighed not more than a few hours after having been shot. A total of 476 partridges were weighed. About 60 % of the weighings were performed by the author and the rest by the sportsmen. The birds were sexed and aged on the basis of the wing samples (see PELLIAINEN

1968 a, 1968 b). The weights recorded included weights of crop contents. The weights of clearly sick individuals were eliminated from the data.

### 2. Results

#### A. Yearly differences

Since the weights of the partridges in the Ostrobothnian study area were recorded regularly throughout the study period (1964 - 1967), it is possible to examine their year-to-year variation. The weights of the different sexes and age classes are presented separately.

**Adult males.** - The mean weights of the adult males are presented in Table 1. A comparison of the mean weights of the years 1964 and 1967 shows that the difference between the weights is not statistically significant ( $t = 0.11$ ). There were no statistically significant differences between the mean weights of the other years either.

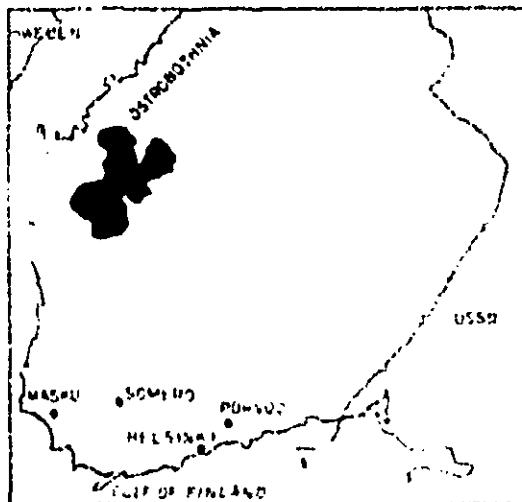


Fig. 1. The study areas in West and South Finland.

Table 1. The weights of the adult male partridges in Ostrobothnia in October in the years 1961 - 1967.

| Year | n  | Mean ± S.E. | Weight, g | S.D. | Relative weight, % | Range |
|------|----|-------------|-----------|------|--------------------|-------|
| 1961 | 3  | 310 ± 15.3  | 26.3      | 19.6 | 100.0              | 110   |
| 1965 | 8  | 305 ± 11.5  | 33.3      | 25.3 | 115 - 150          |       |
| 1966 | 18 | 304 ± 6.3   | 27.3      | 19.3 | 115 - 145          |       |
| 1967 | 39 | 304 ± 3.4   | 27.3      | 19.3 | 100 - 150          |       |

**Adult females.** - The mean weights of the adult females are presented in Table 2. In the years 1961 and 1965 the mean weights were the same (390 g). In 1966 the mean weight was 12 g higher than in 1965. This difference is not, however, statistically significant ( $t = 1.0$ ). In 1967 the mean weight was lower than in 1966. The difference (16 g) is statistically almost significant ( $t = 1.8$ ).

Table 2. The weights of the adult female partridges in Ostrobothnia in October in the years 1961 - 1967.

| Year | n  | Mean ± S.E. | Weight, g | S.D. | Relative weight, % | Range |
|------|----|-------------|-----------|------|--------------------|-------|
| 1961 | 7  | 390 ± 10.4  | 28.3      | 17.3 | 110 - 120          |       |
| 1965 | 5  | 390 ± 5.0   | 15.3      | 9.7  | 110 - 150          |       |
| 1966 | 9  | 392 ± 8.6   | 23.3      | 10.0 | 150 - 170          |       |
| 1967 | 27 | 390 ± 4.6   | 29.3      | 19.3 | 100 - 170          |       |

**Juvenile males.** - The mean weights of the juvenile males are presented in Table 3. In 1961 the mean weight was higher than in 1965. The difference is statistically significant ( $t = 2.3$ ). In the years 1965 - 1967 the mean weights were practically the same. The differences between the mean weights of the years 1961 and 1966, and 1961 and 1967 are statistically significant ( $t = 2.3$  and  $t = 2.1$ , respectively).

Table 3. The weights of the juvenile male partridges in Ostrobothnia in October in the years 1961 - 1967.

| Year | n  | Mean ± S.E. | Weight, g | S.D. | Relative weight, % | Range |
|------|----|-------------|-----------|------|--------------------|-------|
| 1961 | 13 | 303 ± 6.0   | 18.3      | 16.0 | 100.0              | 130   |
| 1965 | 39 | 386 ± 4.1   | 28.3      | 19.3 | 110 - 150          |       |
| 1966 | 51 | 389 ± 4.8   | 23.3      | 19.3 | 110 - 150          |       |
| 1967 | 47 | 390 ± 3.1   | 23.3      | 9.3  | 100 - 135          |       |

**Juvenile females.** - The mean weights of the juvenile females are presented in Table 4. In 1961 the mean weight was higher than in 1965.

The difference is statistically almost significant ( $t = 1.6$ ). In the years 1965 - 1967 the mean weights were virtually the same. The difference between the mean weights of the years 1964 and 1967 is statistically significant ( $t = 2.3$ ), whereas the difference between the mean weights of the years 1964 and 1966 is not statistically significant ( $t = 1.0$ ).

Table 4. The weights of the juvenile female partridges in Ostrobothnia in October in the years 1961 - 1967.

| Year | n  | Mean ± S.E. | Weight, g | S.D. | Relative weight, % | Range |
|------|----|-------------|-----------|------|--------------------|-------|
| 1961 | 21 | 301 ± 5.2   | 23.3      | 16.0 | 110 - 140          |       |
| 1965 | 37 | 378 ± 4.5   | 23.3      | 16.0 | 110 - 125          |       |
| 1966 | 51 | 381 ± 3.6   | 23.3      | 16.0 | 110 - 140          |       |
| 1967 | 41 | 376 ± 2.7   | 17.3      | 9.3  | 110 - 120          |       |

The following points may be noted in connection with the above data. In 1961 the juvenile partridges were heavier than in 1965, whereas during the following years no significant changes were recorded in the mean weights. Practically the same mean weights were recorded for the adult male partridges throughout the study period. During the period 1961 - 1966 no significant differences in the mean weights of the adult female partridges were recorded, though in 1966 the adults were heavier than in 1967.

#### Geographical differences

During the period 1961 - 1967 (in October) 411 partridges were weighed in Ostrobothnia and 65 partridges in southern Finland. The comparison of the mean weights recorded in these areas is presented in Table 5. There are no statistically significant differences in the mean weights of the partridges of the two study areas.

#### C. Weight of different sexes

A total of 344 juvenile partridges were weighed. The mean weight of the 165 females was  $380 \pm 1.4$  g (S.D. = 23.0), and that of the 179 males was  $388 \pm 1.4$  g (S.D. = 23.0). The difference is statistically significant ( $t = 3.3$ \*\*). A total

Table 5. Comparison of the weights of the partridges of Ostrobothnia and southern Finland. The partridges were weighed in October in the years 1961 - 1967.

|                  | Adults |             |      |         |             |      | Juveniles |             |      |         |             |      |
|------------------|--------|-------------|------|---------|-------------|------|-----------|-------------|------|---------|-------------|------|
|                  | Males  |             |      | Females |             |      | Males     |             |      | Females |             |      |
|                  | n      | Mean ± S.E. | S.D. | n       | Mean ± S.E. | S.D. | n         | Mean ± S.E. | S.D. | n       | Mean ± S.E. | S.D. |
| Ostrobothnia     | 68     | 302 ± 2.9   | 21.3 | 48      | 300 ± 3.4   | 22.3 | 150       | 388 ± 2.6   | 21.3 | 145     | 380 ± 1.9   | 23.3 |
| Southern Finland | 10     | 302 ± 7.1   | 21.3 | 0       | 302 ± 15.0  | 31.3 | 20        | 387 ± 4.5   | 25.3 | 20      | 381 ± 5.3   | 23.3 |

of 432 adult partridges were weighed. The mean weight of the females was  $391 \pm 3.9$  g (S.D. 23.6) and that of males was  $402 \pm 2.7$  g (S.D. 23.5). The difference is statistically significant ( $t = 2.61^{**}$ ).

### 3. Discussion

Seasonal changes in the weights of the partridge have been reported by a number of investigators (e.g. Vratislav *et al.* 1955, JANDA 1958, KARIN 1962). Vratislav *et al.* (1955) mentioned that in Hungary the partridges reached their maximum weights (15-113 and < 102 g) in December (females) and January (males). In Czechoslovakia the maximum weights (mean 405 g) were recorded in December (JANDA 1958). In Alberta, Canada, data on the weight of the partridge were collected by the late Wm. HOWAN. On the basis of these data KARIN (1962) reported that both male and female partridges reached their maximum weights (55-122 g and 55-117 g) in January. The mean weights recorded in October during the present study are clearly below the weights mentioned above. On the basis of the small number of weight records collected in Finland in the period November - January (PUNNIVIRTUS, unpublished) it seems that the weight of the partridge increases at least from October to December (or perhaps to January).

In October in Hungary the mean weight of male partridges was 387 g ( $n = 13$ ) and that of females 366 g ( $n = 9$ ) (VRATISLAV *et al.* 1955). At the same time in Czechoslovakia the mean weight of unsexed partridges ( $n = 60$ ) was 370 g. According to the present study in October the mean weight of juvenile females was 31.0 g and that of adult females 391 g. For male birds the weights were 385 and 402 g, respectively. Thus it seems that Bergmann's Rule holds in Europe in partridges, i.e. the partridges from the north are heavier than those from the south. KARIN (1962) dealt with this trend in North America. He mentioned that the mean October - November weight of 29 adult partridges shot in Alberta at latitude  $53^{\circ} - 54^{\circ}$  N was  $416 \pm 11$  g, while that of 12 adults taken during the same months in Washington at latitude  $47^{\circ} - 48^{\circ}$  N was  $386 \pm 18$  g. I think, however, that both the North American and the European data are still too meagre for definite conclusions. In this connection it is worth mentioning that NELSON & MARTIN (1953) reported a progressive increase from south to north in bobwhite (*Colinus virginianus*) weights

(see also HUWITZ 1957). Koskiurus (1958) reported a similar trend in the weight of the black grouse (*Lyrurus tetrix*) in Finland. It must be emphasized that in the present study no differences could be found between the weights of the partridges from Ostrobothnia and southern Finland, but the distance between these two areas is only 250 km in north-south direction.

The present study showed that in October the juvenile partridges are still on an average 11-14 grams lighter than the old birds. However, the heaviest juveniles had already reached the maximum weights of the old birds by this time. HUWITZ (1957) mentioned that on 27. VIII (1951) the mean weight of juvenile partridges was 297 g and that of adults 358 g, whereas on 9. IX (1951) the weights were already 374 and 373 g respectively. KARIN (1962) reported that in October in Alberta, Canada, the juvenile partridges were 31 grams lighter than the adults. In November the difference was still 18 grams. Thus it seems that there are remarkable differences between different areas in this respect. The date of hatching naturally affects the date when the juvenile birds catch up with the adults in weight (for the weight increase of partridge chicks, see e.g. YEATLER 1934, FORD *et al.* 1938, McGANN & HUWITZ 1946, JANDA 1958).

Both the preliminary study (PUNNIVIRTUS 1955) and the present study showed that female partridges are lighter than males. This has been reported earlier by YUARRIA (1934), YOGOYI (1943), NELSON & MARTIN (1953), JANDA (1958) and KARIN (1962), among others. According to the data of VRATISLAV *et al.* (1955), in Hungary female partridges were lighter than males in October, January and March, whereas females were heavier than males in November, December, February, April, May and June. Data from July-September were lacking.

As far as I know, there are no earlier studies on the year-to-year variation in the weights of the partridge. On the other hand, investigations of this kind have been carried out on tetraonids. Koskiurus (1958) reported that there are year-to-year variations of about  $\sim 10\%$  in the average weight of the capercaille (*Tetrao urogallus*) and black grouse in the period October-December. During his investigation the yearly variations in the average weights for this period were in inverse relation to the fluctuations in the average temperature of the same months. Koskiurus (1958) mentioned that the weights of the females seemed to increase more than

those of the males. Zwicker *et al.* (1966) studied autumn weights of the blue grouse (*Dendragapus obscurus fuliginosus*) in Washington, U.S.A. They concluded that the mean weights of adults did not vary annually (with one exception), but the mean weights of juveniles did vary annually. During the present study the mean weights of the adult male partridges did not vary annually, either. Nor did the mean weights of the adult females show any marked annual variation (though the difference in weight between two of the years was almost statistically significant). During the period the mean weights of the juvenile partridges behaved similarly in both sexes

from year to year. The mean weights of both juvenile females and juvenile males decreased from 1964 to 1965, whereas during the following three autumns no marked variations were recorded.

In the preliminary study (Puhakka 1963) the mean weight of the female partridges in October was 383 g and that of the males 397 g. According to the present study the weights were 389 and 392 g respectively. Kivimäki (1949) mentioned that in Finland the weight of the partridge is 390–410 g. On the other hand, Puumala *et al.* (1965) reported that in Finland the mean weight of the partridge is as low as 345 g (n = 23; range 220–475).

### Summary

In October in the years 1964–1967, the mean weights of 111 newly shot partridges from Ostrobothnia (West Finland) and 65 similar individuals from southern Finland were as follows: adult males 402 ± 2.5 (S.D. ± 23.5), adult females 391 ± 3.5 (S.D. ± 23.5), juvenile males 388 ± 1.5 (S.D. ± 24.5) and juvenile females 380 ± 1.5 (S.D. ± 23.5). The females were on an average 9 grams lighter than the males.

There were no differences between the mean weights of the partridges from Ostrobothnia and southern Finland. The mean weights of the adult males from Ostrobothnia did not vary annually. The mean weight of the adult females was practically the same in three successive autumns.

but there was an almost significant decrease from 1966 to 1967. In 1961 the mean weights of the juvenile males and females were greater than in 1965. In the autumns 1965–1967 the mean weights of both the males and the females were virtually unchanged.

In October the juvenile partridges were still 11 (7)–14 (5) grams lighter than the adults.

**Acknowledgments.** I wish to express my gratitude to Professor Esa Kuosa, Head of the Department of Agricultural and Forest Zoology of the University, for working facilities in his institute.

I also wish to thank all those persons who helped in collecting the present data.

This study was supported by grants from the University of Helsinki and the Finnish Foundation for Natural Resources.

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Received 23. 11. 1968

Printed 30. VIII 1968